## REMARKS

This is a full and timely response to the outstanding FINAL Office Action mailed January 17, 2007. The Examiner is thanked for the thorough examination of the present application. Upon entry of this response, claims 1-26 remain pending in the present application. Specifically, the Office Action puts forth the following rejections:

**(1) 35 U.S.C. §102**

a. Claims 8-11, 21, 23, 25, and 26 are rejected under 35 U.S.C. §102(b) as allegedly being anticipated by *Gannett* (U.S. Pub. No. 6,118,452).

**(2) 35 U.S.C. §103**

a. Claims 1-3, 6, 7, and 13 are rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over *Gannett*, in view of *Greene* (U.S. Pat. No. 5,579,455).

b. Claims 4 and 5 are rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over *Gannett*, in view of *Greene*, further in view of *Duluk* (U.S. Pat. No. 6,476,807).

c. Claims 12, 14-20, 22, and 24 are rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over *Gannett*, in view of *Griffin* (U.S. Pat. No. 5,990,904).

Applicants have amended independent claims 1, 8, 13, 14, 21 and have canceled claims 2, 11. Applicants respectfully request consideration of the following remarks contained herein. Reconsideration and allowance of the application and presently pending claims are respectfully requested.

## I. Response to Claim Rejections Under 35 U.S.C. § 102

Claims 8-11, 21, 23, 25, and 26 stand rejected under 35 U.S.C. §102(b) as allegedly being anticipated by *Gannett*. For at least the reasons set forth below, Applicants traverse these rejections.

***Independent Claim 8 is Patentable Over Gannett***

Applicants respectfully submit that independent claim 8 patently defines over *Gannett* for at least the reason that *Gannett* fails to disclose, teach or suggest certain features in claim 8.

Claim 8, as amended, recites:

> 8. A method of rendering a plurality of graphic primitives comprising:
> ***passing, within a graphic pipeline, only a limited portion of the graphic data associated with each primitive, wherein the limited portion of graphic data comprises location-related data; and wherein each primitive comprises a plurality of pixels***;
> processing the limited portion of graphic data associated with each individual primitive;
> determining, for each primitive, whether the primitive has at least one visible pixel;
> communicating data associated with pixels of primitives determined to have at least one visible primitive to a pixel shader for rendering; and
> ***passing and processing, within the pixel shader, the remaining graphic data associated with each primitive only for those primitives determined to have at least one visible pixel, wherein the remaining graphic data includes at least one of the following: lighting, texture, and fog data***.

(*Emphasis added.*) In the *"Response to Amendment"* section of the Office Action, the Examiner disagrees with the Applicants' assertion that *Gannett* does not teach of passing only a limited set of graphics data for each primitive on a first pass (Office Action, pg. 2). However, Applicant respectfully maintains that *Gannett* does not teach this feature and have amended various claims, as indicated above, to clarify this

feature. Applicants submit that this is a basic distinction between the cited *Gannett* reference and each independent claim.

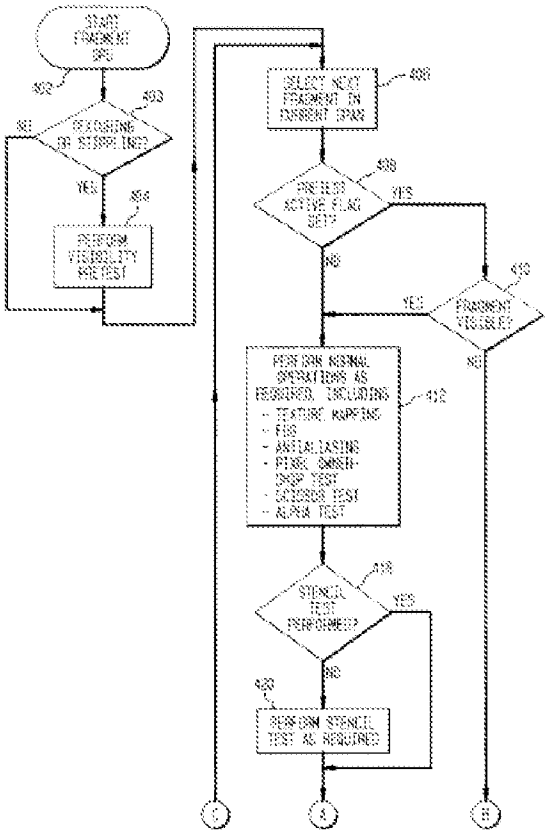
Applicants have amended claim 8 to recite: "*passing*, within a graphic pipeline, *only a limited portion of the graphic data associated with each primitive, wherein the limited portion of graphic data comprises location-related data*; and wherein each primitive comprises a plurality of pixels." Furthermore, claim 8, as amended, now recites, "*passing and processing*, within the pixel shader, *the remaining graphic data associated with each primitive only for those primitives determined to have at least one visible pixel, wherein the remaining graphic data includes at least one of the following: lighting, texture, and fog data*." Applicants respectfully submit that the *Gannett* reference does not teach this feature. The Office Action relies on the following text within the *Gannett* reference:

> By contrast, when performing a visibility pretest operation of the present invention, **the span is traversed twice**. The span is traversed once during the processing performed by the visibility pretest module 202 to determine whether the fragment will be rendered to the video display screen. **The span is traversed a second time during the subsequent per-fragment operations, and only for those spans which have at least one visible fragment. However, the elimination of the fragment operations which would otherwise be performed for the non-visible pixels far outweighs the additional processing associated with the dual traversal of the span.**

(*Emphasis added;* Col. 13, line 65 to Col. 14, line 9) Applicants submit that while *Gannett* teaches of a visibility pretest operation and of performing fragment operations only for visible pixels (*i.e.,* a limited set), *Gannett* does not teach of passing only a limited portion of the graphic data associated with each primitive within the graphic pipeline. That is, *Gannett* appears to teach of passing ALL graphics data (*e.g.,* location data, texture mapping data, fog data, scissor test data) associated with a given

fragment during each pass. Only those fragments which are visible are processed further. However, in the presently claimed embodiments, only a very limited portion of graphics data comprising location-related data (*e.g.,* x, y, z, w coordinates) is passed into the pipeline for each pixel in a given primitive on the first pass. Other graphics data such as lighting and texture information is not passed into the graphics pipeline. This significantly improves the bandwidth of the information being processed within the graphics pipeline on the first pass, resulting in significant bandwidth savings. Applicants refer the Examiner to FIG. 4A in the *Gannett* reference below:

FIG. 4A



If a given fragment is determined to be visible (the YES condition for decision block 410), then normal operations are performed (block 412). Such operations include texture mapping, fog operations, antialiasing, *etc.* Thus, while *Gannett* performs

processing on only a limited number of fragments (*i.e.,* only visible fragments), all the graphics data associated with each fragment is passed down so that it is available in the event that normal operations are to be performed. Indeed, *Gannett* teaches "The span is traversed once during the processing performed by the visibility pretest module 202 to determine whether the fragment will be rendered to the video display screen. The span is traversed a second time during the subsequent per-fragment operations, and only for those spans which have at least one visible fragment." *Gannett* does not appear to make a distinction between what graphics data is passed during the first time and the second time. *Gannett* only teaches that fragment operations are performed for visible fragments rather than for all fragments (*i.e.,* only a limited set of fragments). In contrast, claim 8 recites, "*passing and processing*, within the pixel shader, *the remaining graphic data associated with each primitive* only for those primitives determined to have at least one visible pixel, *wherein the remaining graphic data includes at least one of the following: lighting, texture, and fog data*."

Accordingly, Applicants respectfully submit that independent claim 8 patently defines over *Gannett* for at least the reason that *Gannett* fails to disclose, teach or suggest the highlighted features in claim 8 above.

***Dependent Claims 9-12 are Patentable***

Dependent claims 9-12 are believed to be allowable for at least the reason that they depend from independent claim 8, which is allowable. *See, e.g., In re Fine*, 837 F. 2d 1071 (Fed. Cir. 1988).

***Independent Claim 21 is Patentable Over Gannett***

Applicants respectfully submit that independent claim 21 patently defines over *Gannett* for at least the reason that *Gannett* fails to disclose, teach or suggest certain features in claim 21.

Claim 21, as amended, recites:

> 21. A graphics processor comprising:
> logic configured to ***pass and process only a portion of graphic data passed into a graphic pipeline for each of a plurality of primitives***, in a first pass within the graphic pipeline to determine whether the primitive has at least one visible pixel, wherein each primitive comprises a plurality of pixels; and ***wherein the limited portion of graphic data comprises location-related data***;
> logic configured to render, in a second pass within the graphic pipeline, only the primitives determined in the first pass to have at least one visible pixel, ***wherein the remaining portion of graphic data associated with each primitive is passed into the graphics pipeline on the second pass***.

(*Emphasis added.*) Applicants have amended claims 21, as indicated above, to clarify certain novel features. Claim 21 recites: "logic configured to pass and process only a portion of graphic data passed into a graphic pipeline for each of a plurality of primitives, in a first pass within the graphic pipeline to determine whether the primitive has at least one visible pixel, wherein each primitive comprises a plurality of pixels; and wherein the limited portion of graphic data comprises location-related data." Furthermore, claim 21 recites: ", wherein the remaining portion of graphic data associated with each primitive is passed into the graphics pipeline on the second pass.."

As discussed above, while *Gannett* teaches of a visibility pretest operation and of performing fragment operations only for visible pixels, *Gannett* does not teach of passing and processing only a limited portion of the graphic data within the graphic pipeline. In contrast, *Gannett* appears to teach of passing ALL graphics data (*e.g.,*

location data, texture mapping data, fog data, scissor test data) associated with a given fragment during each pass. Only those fragments which are visible are processed further. In the related text for FIG. 4A, if a given fragment is determined to be visible (the YES condition for decision block 410), then normal operations are performed (block 412). Such operations include texture mapping, fog operations, antialiasing, *etc.* Thus, while *Gannett* performs processing on only a limited number of fragments (*i.e.,* only visible fragments), all the graphics data associated with each fragment is passed down so that it is available in the event that normal operations are to be performed. In contrast, claim 21 recites, "logic configured to render, in a second pass within the graphic pipeline, only the primitives determined in the first pass to have at least one visible pixel, *wherein the remaining portion of graphic data associated with each primitive is passed into the graphics pipeline on the second pass*."

Accordingly, Applicants respectfully submit that independent claim 21 patently defines over *Gannett* for at least the reason that *Gannett* fails to disclose, teach or suggest the highlighted features in claim 21 above.

***Dependent Claims 22-26 are Patentable***

Because independent claim 21 patently defines over *Gannett*, dependent claims 22-26 are allowable over *Gannett* as a matter of law for at least the reason that these claims contain all the features and elements of their corresponding independent claim. *See, e.g., In re Fine*, 837 F. 2d 1071 (Fed. Cir. 1988).

## II. Response to Claim Rejections Under 35 U.S.C. § 103

Claims 1-3, 6, 7, and 13 stand rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over *Gannett*, in view of *Greene*. Claims 4 and 5 stand rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over *Gannett*, in view of *Greene*, further in view of *Duluk*. Finally, claims 12, 14-20, 22, and 24 stand rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over *Gannett*, in view of *Griffin*. For at least the reasons set forth below, Applicants traverse these rejections.

***Independent Claim 1 is Patentable Over Gannett in View of Greene***

Applicants respectfully submit that independent claim 1 patently defines over *Gannett* in view of *Greene* for at least the reason that the combination of *Gannett* and *Greene* fails to disclose, teach or suggest certain features in claim 1.

Claim 1, as amended, recites:

> 1. A multi-pass method of rendering a plurality of graphic primitives comprising:
> in a first pass:
> ***passing only a limited portion of graphic data for each primitive through a graphic pipeline, wherein the limited portion of graphic data comprises location-related data***;
> processing the limited set of data to build a compressed z-buffer, the compressed z-buffer comprising a plurality of z-records, each z-record embodying z information for a plurality of pixels;
> setting a visibility indicator, for each primitive, if any pixel of the primitive is determined to be visible;
> in a second pass:
> for each primitive, determining whether the associated visibility indicator for that primitive is set;
> discarding, without passing through the graphic pipeline, the primitives for which the associated visibility indicator is not set;

> ***passing the remaining portion of graphic data for each primitive determined to have the associated visibility indictor set***;
>
> performing a two-level z-test on graphic data, wherein a first level of the z-test compares the graphic data of a current primitive with corresponding information in the compressed z-buffer, and wherein a second level of the z-test is performed on a per-pixel basis in a z-test manner, wherein the second level z-test is performed only on pixels within a record of the compressed z-information in which the first level z-test determines that some but not all pixels of an associated macropixel are visible; and
>
> communicating data associated with pixels of macropixels determined to be visible to a pixel shader for rendering.

(*Emphasis added.*) The Office Action relies on the *Gannett* reference to assert that *Gannett* teaches the feature, "during the first pass, only a limited set of graphic data for each span is processed since only the visibility pretest operations are performed during the first pass." (Office Action, pg. 9-10). However, Applicants respectfully disagree and submit that there is a distinction between distinction between the cited *Gannett* reference and independent claim 1.

While *Gannett* teaches of a visibility pretest operation and of performing fragment operations only for visible pixels, *Gannett* does not teach of passing and processing only a limited portion of the graphic data within the graphic pipeline. In contrast, *Gannett* appears to teach of passing ALL graphics data (*e.g.,* location data, texture mapping data, fog data, scissor test data) associated with a given fragment during each pass. Only those fragments which are visible are processed further. In the related text for FIG. 4A, if a given fragment is determined to be visible (the YES condition for decision block 410), then normal operations are performed (block 412). Such operations include texture mapping, fog operations, antialiasing, *etc.* Thus, while *Gannett* performs processing on only a limited number of fragments (*i.e.,* only visible

fragments), all the graphics data associated with each fragment is passed down so that it is available in the event that normal operations are to be performed. In contrast, claim 1, as amended, recites the features, "passing only a limited portion of graphic data for each primitive through a graphic pipeline, wherein the limited portion of graphic data comprises location-related data," and "passing the remaining portion of graphic data for each primitive determined to have the associated visibility indictor set." Applicants submit that neither the Gannet reference nor the *Greene* reference teach the features emphasized in claim 1 above.

Accordingly, Applicants respectfully submit that independent claim 1 patently defines over *Gannett* in view of *Greene* for at least the reason that the combination fails to disclose, teach or suggest the features emphasized in claim 1 above.

***Dependent Claims 2-7 are Patentable***

Dependent claims 2-7 are believed to be allowable for at least the reason that they depend from independent claim 1, which is allowable. *See, e.g., In re Fine*, 837 F. 2d 1071 (Fed. Cir. 1988).

***Independent Claim 13 is Patentable Over Gannett in View of Greene***

Applicants respectfully submit that independent claim 13 patently defines over *Gannett* in view of *Greene* for at least the reason that the combination of *Gannett* and *Greene* fails to disclose, teach or suggest certain features in claim 13.

Claim 13, as amended, recites:

> 13. A method of rendering a plurality of graphic primitives comprising:

> passing in a first pass, within a graphic pipeline, only a limited portion of graphic data for each primitive, wherein each primitive comprises a plurality of pixels and ***wherein the limited portion of graphic data comprises location-related data***;
>
> processing the limited set of data to build a compressed z-buffer, the compressed z-buffer comprising a plurality of z-records, each z-record embodying z information for a plurality of pixels;
>
> in a second pass, within the graphic pipeline, performing a two-level z-test on graphic data, wherein a first level of the z-test compares the graphic data of a current primitive with corresponding information in the compressed z-buffer, and wherein a second level of the z-test is performed on a per-pixel basis in a z-test manner, wherein the second level z-test is performed only on pixels within a record of the compressed z-information in which the first level z-test determines that some but not all pixels of a macropixel are visible, ***wherein additional graphic data associated with each primitive is passed into the graphics pipeline on the second pass only for primitives that are at least partially visible***; and
>
> communicating data associated with pixels of macropixels determined to be visible to a pixel shader for rendering.

(*Emphasis added.*) The Office Action relies on the *Gannett* reference to assert that *Gannett* teaches the feature, "during the first pass, only a limited set of graphic data for each span is processed since only the visibility pretest operations are performed during the first pass." (Office Action, pg. 13). However, Applicants respectfully disagree and submit that there is a distinction between the cited *Gannett* reference and independent claim 13 as discussed in depth above. Applicants have amended claim 13 to emphasize this distinction.

Applicants submit that neither *Gannett* nor *Greene* teach the following features recited in claim 13: "*wherein the limited portion of graphic data comprises location-related data*," and "*wherein additional graphic data associated with each primitive is passed into the graphics pipeline on the second pass only for primitives that are at least partially visible*." Accordingly, Applicants respectfully submit that independent claim 13 patently defines over *Gannett* in view of *Greene* for at least the reason that the

combination fails to disclose, teach or suggest the features emphasized in claim 13 above.

***Independent Claim 14 is Patentable Over Gannett in View of Griffin***

Applicants respectfully submit that independent claim 14 patently defines over *Gannett* in view of *Griffin* for at least the reason that the combination of *Gannett* and *Griffin* fails to disclose, teach or suggest certain features in claim 14.

Claim 14, as amended, recites:

> 14. A graphics processor comprising:
> ***first-pass logic configured to deliver to a graphic pipeline, in a first pass, only a limited portion of graphic data for each primitive, wherein each primitive comprises a plurality of pixels, wherein the limited portion of graphic data comprises location-related data***;
> logic configured to process the limited set of graphic data for each primitive to create a compressed z-buffer;
> logic configured to determine, for each primitive, whether the primitive has at least one visible pixel;
> ***second-pass logic configured to deliver to the graphic pipeline, in a second pass, the remaining graphic data associated with each primitive for only those primitives determined to have at least one visible pixel***, the second-pass logic further configured to inhibit the delivery of graphic data to the graphic pipeline for primitives not determined to have at least one visible pixel.

(*Emphasis added.*) The Office Action relies on the *Gannett* reference *"for the teachings as discussed above relative to claim 8."* (Office Action, pg. 18). However, Applicants respectfully disagree and submit that there is a distinction between the cited *Gannett* reference and independent claim 14 as discussed in depth above. Applicants have amended claim 14 to emphasize this distinction.

Applicants submit that neither *Gannett* nor *Greene* teach the following features recited in claim 14: *"first-pass logic configured to deliver to a graphic pipeline, in a first*

*pass, only a limited portion of graphic data for each primitive, wherein each primitive comprises a plurality of pixels, wherein the limited portion of graphic data comprises location-related data,"* and *"second-pass logic configured to deliver to the graphic pipeline, in a second pass, the remaining graphic data associated with each primitive for only those primitives determined to have at least one visible pixel."* Accordingly, Applicants respectfully submit that independent claim 14 patently defines over *Gannett* in view of *Greene* for at least the reason that the combination fails to disclose, teach or suggest the features emphasized in claim 14 above.

***Dependent Claims 15-20 are Patentable***

Dependent claims 15-20 are believed to be allowable for at least the reason that they depend from independent claim 14, which is allowable. *See, e.g., In re Fine*, 837 F. 2d 1071 (Fed. Cir. 1988).

## CONCLUSION

Applicants respectfully submit that all pending claims are in condition for allowance. Favorable reconsideration and allowance of the present application and all pending claims are hereby courteously requested. If, in the opinion of the Examiner, a telephone conference would expedite the examination of this matter, the Examiner is invited to call the undersigned attorney at (770) 933-9500.

No fee is believed to be due in connection with this amendment and response to Office Action. If, however, any fee is believed to be due, you are hereby authorized to charge any such fee to deposit account No. 20-0778.

Respectfully submitted,

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